

Glider Surveys of Japan/East Sea Circulation

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LONG-TERM GOAL

The long term goal of this project is to observe and understand the circulation of the Japan/East Sea in the vicinity of the subpolar front.

OBJECTIVES

The objective of this project is to collect temperature and salinity profiles using a small fleet of autonomous underwater vehicles now under development. The Japan/East Sea surveys will be the first dedicated scientific use of this technology. These profiles, collected both at fixed geographic locations and along transects, will be used to estimate geostrophic transport of the subpolar frontal region and to describe water mass transformation processes. Observations are intended to be continuous over a complete annual cycle.

APPROACH

Our approach is to field a small network of comparatively inexpensive autonomous vehicles that can collect temperature and salinity profiles continuously from the upper km of the ocean while either maintaining their geographic positions or surveying along a desired track. This network is to report measurements in near real-time and be controllable from shore. These vehicles are to be launched from a small boat near shore in South Korea, carry out a multimonth survey, and be recovered similarly in Japanese waters.

We are collaborating with Prof. Kuh Kim (Seoul National University, South Korea) and Prof. Yoon (Kyushu University, Japan) to carry out field work and analyze the measurements.

Glider development and construction of the units to be used in this study are being supported through other ONR grants (the Multidisciplinary University Research Initiative project on Autonomous Oceanographic Sampling Networks and the Defense University Research Instrumentation Program). A prototype glider vehicle is now being tested in Puget Sound. The plan is to be ready to launch 3 vehicles in the Japan/East Sea in the late summer or fall of 1999.

WORK COMPLETED

This project is in its first year of support. The principal tasks have been planning activities. We attended a meeting in Seoul, South Korea in April, 1998 to meet colleagues in the Circulation Research of East Asian Marginal Seas (CREAMS) program from South Korea, Japan, and Russia. After the meeting, we visited the East Sea Ocean Research Center (ESOREC) near Tonghae, S. Korea, to evaluate

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it as a possible staging site for glider final preparation and launch. We also travelled to Fukuoka and Mutsu, Japan, in January, 1998 (a trip supported by Japan) to plan the recovery of glider vehicles.

RESULTS

The planned sampling scheme for glider surveys is shown in Figure 1. The plan is for three gliders to be launched near Tonghae, after which they will carry out a survey over a roughly 100 km wide region as they transit to the subpolar front near 40°N. Two of the gliders will take up fixed positions 100 km apart across the front while the third will execute a survey along a 100X100 km square track. Gliders will take turns carrying out the box survey, offering the opportunity to intercalibrate CTD sensors. Four to six months after the launch, a second group of three gliders will be deployed near shore to replace those at the subpolar front. When these reach the front, the original group will transit east along the front, crossing it several times, enroute to recovery near Akita, Japan, again by small boat. The goal of the survey is to collect temperature and salinity profiles from the sea surface to 1 km depth every 4 hours for a year at two sites, and carry out a multiple-vehicle survey across the Japan/East Sea in different seasons.

IMPACT/IMPLICATIONS

The expected impact of successful use of gliders in the Japan/East Sea is that it will demonstrate how hydrographic profile surveys can be made at much lower cost than is now possible using moorings or ships. The ocean can then be sampled much more densely and over longer duration than is conventionally practical. The expected cost of 1 m resolution joint temperature/salinity profiles from the surface to 1 km depth at an arbitrary location, reported in near real-time, is under \$20.

This study will provide a description of the subpolar front in the Japan/East Sea at unprecedented resolution in time and space. Modeling studies will be able to use the measurements to test their fidelity to reality and ability to predict the state of the Japan Sea. This work is intended as a demonstration project of the potential for gliders in studying the ocean.

RELATED PROJECTS

This project is supported in part by the Multidisciplinary University Research Initiative (MURI): “Real-Time Oceanography with Autonomous Sampling Networks: A Center for Excellence”

REFERENCES

See the MURI-AOSN web site: http://web.mit.edu/seagrant/www/MURI_home.html

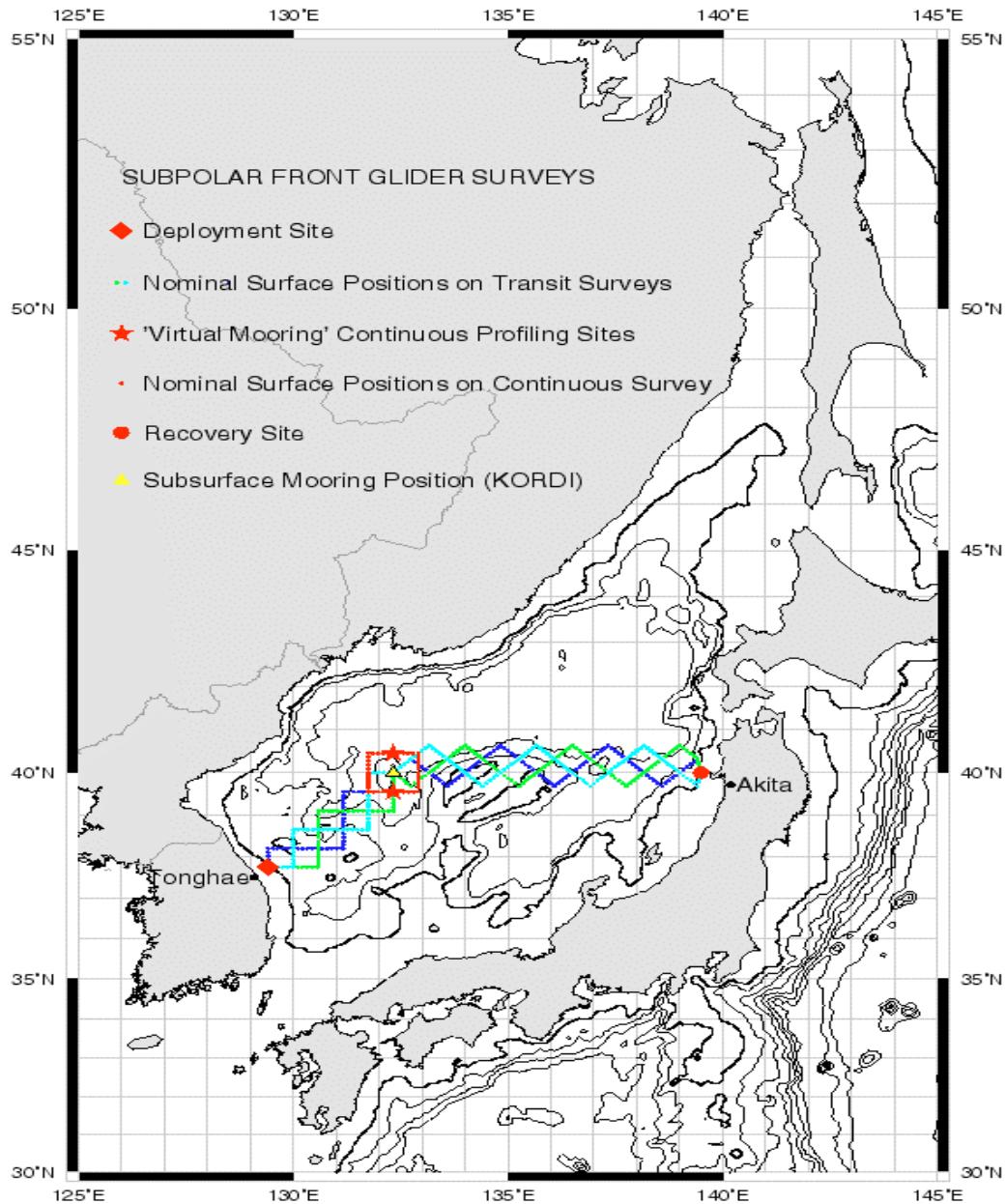


Figure 1. The glider sampling plan superimposed on bathymetry of the Japan/East Sea. The subpolar front is found near 40°N across the basin. Individual symbols indicate the spatial sampling density (~10 km) of the surveys by indicating nominal sites where gliders will reach the surface.